

REMARKS

The present application is a divisional application of U.S. Serial No. 09/692,437 resulting from a Restriction Requirement.

The proposed amendments to the specification are to correct minor typographical errors and do not add any new matter to the application.

Attached hereto is a PTO Form 1449 indicating prior art that was cited in the prosecution of U.S. Serial No. 08/979,714.

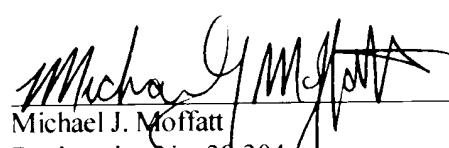
If the Examiner believes that a telephone interview will help further the prosecution of this case, the Examiner is respectfully requested to contact the undersigned attorney at the listed telephone number.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 16-2462 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

PRICE AND GESS

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Please see attached pages.

1 1. A PDP comprising:

2 a first plate which is provided with a first electrode
3 on a main surface, the first electrode being made of
4 silver, and the first electrode being coated with a first
5 dielectric layer;

6 a second plate which is provided with a second
7 electrode on a main surface, wherein the first plate and
8 the second plate are placed in parallel so that the main
9 surfaces of the first plate and the second plate face each
10 other with a certain distance therebetween; and
11 spacing means which is provided between the first
12 plate and the second plate so that a discharge space is
13 formed between the first plate and the second plate.

14 wherein

15 a first metallic oxide layer on whose surface OH
16 groups exist is formed between the first electrode and the
17 first dielectric layer, the first metallic oxide layer
18 being 10 μ m or less in thickness.

1 2. The PDP defined in Claim 1, wherein

2 the first metallic oxide layer is formed with a CVD

3 method.

1 3. The PDP defined in Claim 1, wherein
2 a thickness of the first dielectric layer is in a
3 range of 5 μ m to 14 μ m.

1 4. The PDP defined in Claim 1, wherein
2 the first metallic oxide layer is made of at least one
3 of zinc oxide (ZnO), zirconium oxide (ZrO₂), magnesium
4 oxide (MgO), titanium oxide (TiO₂), silicon oxide (SiO₂),
5 aluminum oxide (Al₂O₃), and chromium oxide (Cr₂O₃).

1 5. The PDP defined in Claim 4, wherein
2 the first dielectric layer is made of one of a lead
3 oxide glass whose dielectric constant is 10 or more and a
4 bismuth oxide glass whose dielectric constant is 10 or
5 more, wherein
6 the lead oxide glass includes lead oxide (PbO), boron
7 oxide (B₂O₃), silicon oxide (SiO₂), and aluminum oxide
8 (Al₂O₃), and the bismuth oxide glass includes bismuth
9 oxide (Bi₂O₃), zinc oxide (ZnO), boron oxide (B₂O₃),
10 silicon oxide (SiO₂), and calcium oxide (CaO).

1 6. The PDP defined in Claim 5, wherein
2 either of the lead oxide glass and the bismuth oxide
3 glass used to form the first dielectric layer includes
4 titanium oxide (TiO_2) in a range of 5% to 10% by weight
5 and has a dielectric constant of 13 or more.

1 7. A PDP comprising:
2 a first plate which is provided with a first electrode
3 on a main surface, the first electrode being made of a
4 metal, and the first electrode being coated with a first
5 dielectric layer;
6 a second plate which is provided with a second
7 electrode on a main surface, wherein the first plate and
8 the second plate are placed in parallel so that the main
9 surfaces of the first plate and the second plate face each
10 other with a certain distance therebetween; and
11 spacing means which is provided between the first
12 plate and the second plate so that a discharge space is
13 formed between the first plate and the second plate,
14 wherein
15 a surface of the first electrode undergoes oxidation
16 to be a metallic oxide.

1 8. The PDP defined in Claim 7, wherein
2 the metal used to make the first electrode is either
3 of tantalum and aluminium.

1 9. A PDP comprising:
2 a first plate which is provided with a first electrode
3 on a main surface, the first electrode being coated with
4 a first dielectric layer;
5 a second plate which is provided with a second
6 electrode on a main surface, wherein the first plate and
7 the second plate are placed in parallel so that the main
8 surfaces of the first plate and the second plate face each
9 other with a certain distance therebetween; and
10 spacing means which is provided between the first
11 plate and the second plate so that a discharge space is
12 formed between the first plate and the second plate,
13 wherein
14 the first electrode includes a transparent electrode
15 part and a metallic electrode part, the transparent
16 electrode part being placed on the main surface of the
17 first plate and the metallic electrode part being placed
18 on the transparent electrode part, and
19 a surface of the metallic electrode part undergoes

20 oxidation to be a metallic oxide.

1 10. A PDP comprising:

2 a first plate which is provided with a first electrode
3 on a main surface, the first electrode being coated with
4 a first dielectric layer;

5 a second plate which is provided with a second
6 electrode on a main surface, wherein the first plate and
7 the second plate are placed in parallel so that the main
8 surfaces of the first plate and the second plate face each
9 other with a certain distance therebetween; and

10 spacing means which is provided between the first
11 plate and the second plate so that a discharge space is
12 formed between the first plate and the second plate,

13 wherein

14 the first dielectric layer is a layer made of a
15 metallic oxide with a vacuum process method.

1 11. The PDP defined in Claim 10, wherein

2 the metallic oxide is one of zirconium oxide, titanium
3 oxide, zinc oxide, bismuth oxide, cesium oxide, antimony
4 oxide, aluminium oxide, silicon dioxide, and magnesium
5 oxide.

1 12. The PDP defined in Claim 10, wherein
2 the first dielectric layer is formed with a CVD method
3 and is 3 μ m-6 μ m in thickness.

1 13. The PDP defined in Claim 10, wherein
2 the first dielectric layer is coated with a magnesium
3 oxide protecting layer.

1 14. The PDP defined in Claim 10, wherein
2 the first plate is made of borosilicate glass
3 including 6.5% or less by weight of alkali.

1 15. The PDP defined in Claim 14, wherein
2 a thickness of the first plate is in a range of 0.1mm
3 to 1.5mm.

1 16. The PDP defined in Claim 14, wherein
2 the borosilicate glass has a distortion point of 535°C
3 or more and a thermal expansion coefficient of $51 \times 10^{-7}/^{\circ}\text{C}$
4 or less.

1 17. A PDP comprising:

2 a first plate which is provided with a first electrode
3 on a main surface, the first electrode being coated with
4 a first dielectric layer;
5 a second plate which is provided with a second
6 electrode on a main surface, wherein the first plate and
7 the second plate are placed in parallel so that the main
8 surfaces of the first plate and the second plate face each
9 other with a certain distance therebetween; and
10 spacing means which is provided between the first
11 plate and the second plate so that a discharge space is
12 formed between the first plate and the second plate,
13 wherein
14 the first dielectric layer is formed with a plasma
15 spraying method.

1 18. The PDP defined in Claim 17, wherein
2 the first dielectric layer is made of one of a glass
3 containing lead oxide (PbO), boron oxide (B_2O_3), silicon
4 dioxide (SiO_2), and aluminium oxide (Al_2O_3), and a glass
5 containing phosphorus oxide (P_2O_5), zinc oxide (ZnO),
6 aluminium oxide (Al_2O_3), and calcium oxide (CaO), wherein
7 a thermal expansion coefficient of each of the glasses
8 is in a range of $45 \times 10^{-7}/^{\circ}C$ to $50 \times 10^{-7}/^{\circ}C$.

1 19. The PDP defined in Claim 18, wherein
2 the first plate and the second plate are respectively
3 made of borosilicate glass including 6.5% or less by
4 weight of alkali.

1 20. A PDP comprising:
2 a first plate which is provided with a plurality of
3 first electrodes on a main surface, the plurality of first
4 electrodes being coated with a first dielectric layer;
5 a second plate which is provided with a plurality of
6 second electrodes on a main surface, wherein the first
7 plate and the second plate are placed in parallel so that
8 the plurality of first electrodes and the plurality of
9 second electrodes face each other with a certain distance
10 between the first plate and the second plate; and
11 a plurality of partition walls which protrude from the
12 main surface of either of the first plate and the second
13 plate to partition a space between the first plate and the
14 second plate so that a plurality of discharge spaces are
15 formed, wherein
16 the plurality of partition walls are formed with a
17 plasma spraying method.

1 21. The PDP defined in Claim 20, wherein
2 each of the plurality of partition walls is made of at
3 least one of aluminium oxide (Al_2O_3) and mullite
4 ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$).

1 22. The PDP defined in Claim 21, wherein
2 the [first] plate and the second plate are respectively
3 made of borosilicate glass including 6.5% or less by
4 weight of alkali.

1 23. The PDP defined in Claim 21, wherein
2 the plurality of partition walls, which protrude from
3 the main surface of the first plate, and the second
4 electrode are coated with a second dielectric layer.

1 24. A PDP comprising:
2 a first plate which is provided with a first electrode
3 on a main surface, the first electrode being coated with
4 a first dielectric layer;
5 a second plate which is provided with a second electrode
6 on a main surface, wherein the first plate and
7 the second plate are placed in parallel so that the main

8 surfaces of the first plate and the second plate face each
9 other with a certain distance therebetween; and
10 spacing means which is provided between the first
11 plate and the second plate so that a discharge space is
12 formed between the first plate and the second plate,
13 wherein

14 the first dielectric layer comprises a lower part and
15 an upper part, the lower part, made of a metallic oxide,
16 being formed on the first electrode with a vacuum process
17 method and the upper part formed by applying and baking a
18 dielectric glass on the lower part.

1 25. The PDP defined in Claim 1, wherein
2 a second dielectric layer is provided on the second
3 electrode on the second plate, and
4 a second metallic oxide layer on whose surface OH
5 groups exist is formed between the second electrode and
6 the second dielectric layer, the second metallic oxide
7 layer being 10 μ m or less in thickness.

1 26. The PDP defined in Claim 25, wherein
2 the second metallic oxide layer is formed with a CVD
3 method.

1 27. The PDP defined in Claim 26, wherein
2 a thickness of the second dielectric glass layer is in
3 a range of 5 μ m to 14 μ m.

1 28. The PDP defined in Claim 25, wherein
2 the second metallic oxide layer is made of at least
3 one of zinc oxide (ZnO), zirconium oxide (ZrO₂), magnesium
4 oxide (MgO), titanium oxide (TiO₂), silicon oxide (SiO₂),
5 aluminum oxide (Al₂O₃), and chromium oxide (Cr₂O₃).

1 29. The PDP defined in Claim 7, wherein
2 a second dielectric layer is provided on the second
3 electrode and the second electrode is made of a metal,
4 wherein
5 a surface of the second electrode undergoes oxidation
6 to be a metallic oxide.

1 30. A method for producing a PDP comprising:
2 a first step of attaching a first electrode made of
3 silver onto a main surface of a first plate and forming
4 with a CVD method a layer made of a metallic oxide on a
5 surface of the first electrode, wherein, on exposure to

6 air, OH groups are generated on a surface of the layer
7 made of the metallic oxide;

8 a second step of coating the layer made of the
9 metallic oxide with a dielectric layer while OH groups
10 exist on the surface of the layer made of the metallic
11 oxide;

12 a third step of preparing a second plate; and

13 a fourth step of placing the first plate and the
14 second plate in parallel to face each other, with spacing
15 means being placed between the first plate and the second
16 plate, so that a discharge space is formed between the
17 first plate and the second plate.

1 31. The method for producing a PDP defined in Claim 30.
2 wherein

3 in the first step, either of a metal chelate and a
4 metal alkoxide compound is used as a source material for
5 the CVD method.

1 32. The method for producing a PDP defined in Claim 30.
2 wherein

3 in the first step, a compound used as a source
4 material for the CVD method is at least one of zinc,

5 zirconium, magnesium, titanium, silicon, aluminium, and
6 chromium.

1 33. The method for producing a PDP defined in Claim 30,

2 wherein

3 in the second step, the dielectric layer is made of
4 one of a lead oxide glass whose dielectric constant is 10
5 or more and a bismuth oxide glass whose dielectric
6 constant is 10 or more, wherein

7 the lead oxide glass includes lead oxide (PbO), boron
8 oxide (B_2O_3), silicon oxide (SiO_2), and aluminum oxide
9 (Al_2O_3), and the bismuth oxide glass includes bismuth
10 oxide (Bi_2O_3), zinc oxide (ZnO), boron oxide (B_2O_3),
11 silicon oxide (SiO_2), and calcium oxide (CaO).

1 34. A method for producing a PDP comprising:

2 a first step of attaching a first electrode made of a
3 metal onto a main surface of a first plate and forming
4 with oxidation a layer made of a metallic oxide on a
5 surface of the first electrode;

6 a second step of coating the layer made of the
7 metallic oxide with a dielectric layer;

8 a third step of preparing a second plate; and

9 a fourth step of placing the first plate and the
10 second plate in parallel to face each other, with spacing
11 means being placed between the first plate and the second
12 plate, so that a discharge space is formed between the
13 first plate and the second plate.

1 35. The method for producing a PDP defined in Claim 34,
2 wherein

3 the oxidation in the first step is performed with an
4 anodic oxidation method.

1 36. A method for producing a PDP comprising:
2 a first step of attaching a first electrode onto a
3 main surface of a first plate and forming a dielectric
4 layer on a surface of the first electrode with a vacuum
5 process method;
6 a second step of preparing a second plate; and
7 a third step of placing the first plate and the second
8 plate in parallel to face each other, with spacing means
9 being placed between the first plate and the second plate,
10 so that a discharge space is formed between the first
11 plate and the second plate.

producing a PDP defined in Claim 36.

ayer formed in the first step is a
at least one of zirconium, titanium,
m, silicon, aluminium, antimony, and

producing a PDP defined in Claim 36,

st step and the second step, there is
magnesium oxide protecting layer for
electric layer with a vacuum process
after the dielectric layer is formed in

producing a PDP defined in Claim 36,

ess method used in the first step is a

producing a PDP defined in Claim 39.

used as a source material for the CVD

4 method in the first step, the compound including at least
5 one of zirconium, titanium, zinc, bismuth, cesium,
6 silicon, aluminium, antimony, and magnesium.

1 41. The method for producing a PDP defined in Claim 36,
2 wherein

3 the first plate used in the first step is made of
4 borosilicate glass including 6.5% or less by weight of
5 alkali.

1 42. A method for producing a PDP comprising:
2 a first step of attaching a first electrode onto a
3 main surface of a first plate and forming a dielectric
4 layer on a surface of the first electrode with a plasma
5 spraying method;
6 a second step of preparing a second plate; and
7 a third step of placing the first plate and the second
8 plate in parallel to face each other, with spacing means
9 being placed between the first plate and the second plate,
10 so that a discharge space is formed between the first
11 plate and the second plate.

1 43. The method for producing a PDP defined in Claim 42.

2 wherein

3 a material for the plasma spraying method in the first
4 step is one of a glass containing lead oxide (PbO), boron
5 oxide (B_2O_3), silicon dioxide (SiO_2), and aluminium oxide
6 (Al_2O_3), and a glass containing phosphorus oxide (P_2O_5)
7 zinc oxide (ZnO), aluminium oxide (Al_2O_3), and calcium
8 oxide (CaO), wherein

9 a thermal expansion coefficient of each of the glasses
10 is in a range of $45 \times 10^{-7}/^{\circ}C$ to $50 \times 10^{-7}/^{\circ}C$.

1 44. The method for producing a PDP defined in Claim 42.

2 wherein,

3 the first plate used in the first step is made of
4 borosilicate glass including 6.5% or less by weight of
5 alkali.

1 45. A method for producing a PDP comprising:

2 a first step of attaching a first electrode onto a
3 main surface of a first plate, and forming with a plasma
4 spraying method a plurality of partition walls on the main
5 surface of the first plate, wherein at least a part of the
6 first electrode is exposed;
7 a second step of preparing a second plate; and

8 a third step of placing the first plate and the second
9 plate in parallel to face each other, with the plurality
10 of partition walls being placed between the first plate
11 and the second plate so that a discharge space is formed
12 between the first plate and the second plate.

1 46. The method for producing a PDP defined in Claim 45,
2 wherein

3 a source material for the plasma spraying method in
4 the first step is at least one of aluminium oxide (Al_2O_3)
5 and mullite ($3\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$).

1 47. The method for producing a PDP defined in Claim 45,
2 wherein

3 between the first step and the second step, a
4 dielectric layer is formed to coat the main surface of the
5 first plate on which the first electrode and the plurality
6 of partition walls exist.

1 48. The method for producing a PDP defined in Claim 45,
2 wherein

3 the first plate used in the first step is made of
4 borosilicate glass including 6.5% or less by weight of

5 alkali.

ABSTRACT

A PDP does not suffer from dielectric breakdown even though a dielectric layer is thin, with the problems of conventional PDPs, such as cracks appearing in the glass substrates during the production of the PDP being avoided.

To do so, the surface of silver electrodes of the PDP is coated with a $0.1\text{-}10\mu\text{m}$ layer of a metallic oxide, on whose surface OH groups exist, such as ZnO , ZrO_2 , MgO , TiO_2 , Al_2O_3 , and Cr_2O_3 . The metallic oxide layer is then coated with the dielectric layer. It is preferable to form the metallic oxide layer with the CVD method. The surface of a metallic electrode can be coated with a metallic oxide, which is then coated with a dielectric layer. The dielectric layer can be made of a metallic oxide with a vacuum process method or the plasma thermal spraying method. The dielectric layer formed on electrodes with the CVD method is remarkably thin and flawless. When the dielectric layer is formed with the vacuum process method or the plasma spraying method, warping and cracks conventionally caused by baking the dielectric layer are prevented. Here, borosilicate glass including 6.5 % or less by weight of alkali can be used as the glass substrate.